

H. The system shall be modular to allow future expansion with a minimum of hardware additions.

I. Provide equipment by one of the following manufacturers or approved equal:

Notifier
Gamewell/FCI
Edwards Systems Technology

- A. The Authority may appoint a Construction Coordinator as the Owner's representative for the duration of the project. Any reference to the Owner in the Contract Documents includes the Owner's representative.

QUALITY ASSURANCE

- A. This specification identifies the essential functional requirements of the fire alarm, detection, and voice evacuation systems. Each manufacturer's equipment (hardware and software) and system configuration shall comply with or exceed the functional intent of this Specification.
- B. Each component of the Fire Alarm System shall be listed as a compatible product of a single fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "UL" label. All control equipment shall be listed under UL category UOJZ Control Units System as a single unit. Partial listings or multiple listings for various major sections of the control unit shall not be acceptable. All equipment shall also bear the FM approval seal.
- C. The equipment furnished under this Section shall be provided by a Fire Alarm System Supplier who has been providing this type of equipment for the past five years. The System Supplier and the Electrical Contractor shall have a service organization which is capable of providing a factory-trained, NICET Level 3 Certified service technician at the site within 24 hours of a request for on-site service.
- D. All control equipment shall have transient protection devices to comply with UL864 requirements.

SCOPE

- A. The work covered by this specification is the installation of a complete electronic fire detection, alarm, control, and voice evacuation system at Building, Location, Massachusetts. The work shall also cover the installation or the removal of fire detection, alarm, and control systems as received. The signaling line circuit shall be Class A, Style 6. The visual notification appliance circuit shall be a 2 wire, Class B, Style W circuit. The audible notification appliance circuit shall be a 2 wire, Class A, Style Z circuit. The notification appliances shall activate and de-activate simultaneously.
- B. The Contractor shall furnish, install, test, and place into full operating condition a complete 24 VDC closed-circuit, electrically supervised; individual device annunciated fire alarm system as specified herein and indicated on the drawings. The systems shall include, but not be limited to, all control and communication equipment, power supplies, signal initiating devices, audible and visual alarm notification appliances, conduit, wire, fittings, and all other accessories required

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manufacturer to distribute and service the equipment and that they have satisfactorily completed all training courses offered by the manufacturer relating to the equipment provided.

- G. The manufacturer or his authorized distributor shall confirm that, within reasonable distance of the job site, there is an established agency which stocks a full complement of parts; offers services during normal working hours on all equipment to be furnished; and will supply parts without delay and at reasonable cost.
- H. The manufacturer or his authorized distributor shall confirm that it has the capability to provide emergency service within twenty-four (24) hours of notification of the need for such service.

Codes and Standards

- A. All equipment, devices, cables, and appliances furnished shall be listed by Underwriters Laboratories, Inc., for use in Fire Protective Signaling Systems under the following applicable standards:

UL 864	Control Units for Fire Protective Signaling Systems
UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 268A	Smoke Detectors for Duct Applications
UL 521	Heat Detectors for Fire Protective Signaling Systems
UL 228	Door Closers-Holders for Fire Protective Signaling Systems
UL 464	Audible Signaling Appliances
UL 1638	Visual Signaling Appliances
UL 38	Manually Actuated Signaling Boxes
UL 346	Water flow Indicators for Fire Protective Signaling Systems
UL 1481	Power Supplies for Fire Protective Signaling Systems
- B. All equipment shall be Listed by Underwriters Laboratory or approved by Factory Mutual.
- C. The system shall comply with all state and local codes, including The Massachusetts State Building Code -8th edition, Massachusetts General Law, 527 CMR, 521 CMR and the requirements of the local Fire Department, without exception.
- D. Installation shall be in accordance with the provisions of the equipment manufacturer's guidelines, and with the provisions of the state and local code references for the following:
 - 1. National Fire Protection Association Standard 70, National Electrical Code, Article 760, Fire Protective Signaling Systems, 2008, as referenced by the Massachusetts Electrical Code (527

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2. National Fire Protection Association Standard 72, National Fire Alarm Code, 2007
- E. The system shall be tested in accordance with the following:
1. National Fire Protection Association Standard 72, National Fire Alarm Code, 2007
 2. The latest edition of the equipment manufacturer's guidelines
- F. The completed system shall be certified as follows:
1. The completed system shall be tested by the Authority Having Jurisdiction. The system shall not be considered finished until completion of this test and acceptance by the Authority Having Jurisdiction.
 2. The Contractor shall provide signed certificate of compliance as shown in National Fire Protection Association Standard 72, National Fire Alarm Code, 2007.
- G. Through-Penetration Fire Stop Systems shall be listed by Underwriters Laboratories, Inc., for Compliance with UL 1479 A Fire Tests of Through-Penetration Firestops. @ Material selection, submittals, and procedures shall comply with the architectural fire stopping specification section.

Related Documents

- A. Drawings supplied with this specification shall be used by the contractor as a guide to the required quantities and locations of the system components. The Contractor shall follow the selected manufacturer's instructions and provide additional equipment as necessary to assure that the selected system provides coverages consistent with the intent of this specification and the drawings.
- B. The requirements of building permits and authorizations to proceed shall become a part of this specification. All required licences, permits and authorizations to proceed and all associated fees shall be obtained and paid for by the Contractor.
- C. Prior to commencement and upon completion of work, the Contractor shall provide written notification to the authorities having jurisdiction.
- D. The Contractor shall notify the Engineer, in writing, when the system is ready for final acceptance testing. The system shall be considered ready for final approval testing only after all preliminary tests have been made by the Contractor and the manufacturer's technical representative and all deficiencies have been found and corrected. In

addition, two (2) copies of a report, prepared by the Contractor and the manufacturer's technical representative and signed by them, attesting that the system is complete satisfactory and in fully operable condition, must be submitted to the Engineer before a final test will be scheduled. Final acceptance testing shall include a pretest witnessed by the Engineer prior to scheduling of the final test to be witnessed by the Fire Department.

Order of Precedence

- A. Should conflicts arise out of discrepancies between documents referenced in this specification, the more stringent requirement shall apply; however, should a level of stringency be undeterminable, the discrepancies shall be resolved as follows:
 - 1. State and local codes shall take precedence.
 - 2. The National Fire Protection Association Standards shall take precedence over this specification.
 - 3. This specification shall take precedence over the drawings.

Related Work

- A. The Fire Alarm contractor shall coordinate work in this Section with all related trades. Work and/or equipment provided in other Sections and related to the fire alarm and protective system shall include, but not be limited to:
 - 1. The Fire Alarm contractor shall be responsible for coordination with all involved contractors.
 - 2. The Fire Alarm contractor shall be responsible for documenting and providing through penetration seals for all penetrations through fire rated assemblies.
 - 3. The Contractor shall be responsible for coordinating with the general contractor for patching and painting as a result of the removal of existing equipment.
- B. The fire alarm contractor shall be responsible for connecting to all sprinkler system flow and valve tamper supervision contacts. These shall be connected to the fire alarm signaling line circuit.
- C. A responsible representative of the Fire Alarm contractor shall participate in project meetings with the engineer and owner's representative as specified by the architect.
- D. All electrical boxes on finished surfaces shall be flush mounted where possible. At a minimum all installations shall meet the approval of the architect for aesthetic purposes.

indicating years in business, service capabilities and policies, warranty definitions, spare parts support, and a list of similar installations.

2. Confirmation that the equipment supplier will provide on-site project management and supervision during system installation, perform system testing, and instruct building personnel on system operation and maintenance.
3. Foreman's qualifications indicating training both in electrical trade and fire alarm system installation.
4. The name of all Sub-Contractors and their qualifications indicating years to business and prior experience with installations that include the type of equipment that is supplied.
5. Delivery dates of the equipment to be supplied.
6. Provide a detailed presentation and description of the system operation.
7. Equipment other than specified will be considered for approval. It shall be the Contractors obligation to submit data and information to allow the Engineer time to consider the equality of the substituted items to that specified. It is the Contractors responsibility to meet the entire intent of the specifications. Deviations from the specified items shall be at the risk of the Contractor until the date of final acceptance by the Engineer. Accepted submittals on substitute equipment shall only allow the Contractor to proceed with proposing a substituted item and shall not be considered equal until such time as the Engineer has completely accepted the substitute item. The Contractor shall provide the following in writing to the Engineer ten (10) days before the bid date:
 - a) Complete lists, descriptions, and drawings of materials proposed to be substituted.
 - b) A complete riser diagram of the proposed substituted fire alarm system.
 - c) All pertinent information regarding the reliability and operation of the equipment proposed to be substituted.
 - d) Manufacturers' original catalog data and descriptive information for all components of the system proposed to be substituted.
8. The Engineer, at his sole choice and discretion, may request a demonstration of the proposed equipment.

suppliers, or subcontractors will be accepted.

- F. The Contractor shall be at risk for any attempt to substitute the equipment suppliers or Subcontractors accepted. All costs, including those for removal, relocation, or replacement of a substituted item, shall be at the risk of the Contractor.
- G. Upon written request from the Contractor, the Engineer may authorize changes, but at his sole choice and discretion.
- H. It is the Contractor's responsibility to meet the entire intent of the specifications. If any attempt is made to substitute another product or brand for that product and brand of equipment specified, it shall be the Contractor's obligation to submit the above data and information to allow the Owner and specifying Engineer time to consider the equality of the substituted items to that specified.
- I. Deviations from the specified items shall be at the risk of the Contractor until the date of final acceptance by the Engineer. Approved submittals on substitute equipment shall only allow the Contractor to proceed with installing a substituted item and shall not be considered equal until such time as the Engineer has completely accepted the substitute item. All costs, including those for removal, relocation, or replacement of a substituted item, shall be at the risk of the Contractor.
- J. The Contractor shall submit six (6) copies of the following prior to performing any work:
 - 1. For tie-in to an existing building fire alarm system, a schedule indicating the installation sequence, the time frame, and details on how the fire alarm control panel activation and switch-over will occur. This schedule shall ensure that system down-time is kept to a minimum. Projected dates of delivery of the equipment to be supplied, installation completion, demonstration test and final test/acceptance dates shall be included.
 - 2 Shop drawings as follows: proposed equipment locations, penetrations through fire rated barriers, and conduit routing.
 - a. Complete point-to-point, color-coded, detailed wiring diagram which includes all wire specifications, control wiring device terminations and terminal strip designations required for the fire alarm detection systems as indicated on the drawings or described herein. Plans depicting typical installations will not be acceptable.
 - b. Complete point-to-point fire alarm conduit routing plan must be submitted and approved prior to the start of installation.
 - c. Addresses for all field devices shown on floor plans, along with key lists.

- d. Large scale drawings of the FACP, Graphic Annunciator, and any remote control panels showing field wiring in full detail.
- e. All Acoustically Distinguishable Spaces shall be indicated on the shop drawings where voice intelligibility is where required.
- f. Included with the shop drawings shall be original manufacturer's specification and installation instruction sheets. Copies will not be acceptable. All equipment and devices on the shop drawings to be furnished under this contract shall be clearly marked in the specification sheets. If any equipment and/or devices required in the system are not so marked, the Owner shall mark the sheet, and this equipment and/or devices shall be made part of the system and shall be provided.
- g. A riser diagram of the complete fire alarm control system. The riser diagram shall include an indication of the wire specification for each circuit in the riser diagram.
- h. A complete list of current requirements during normal, supervisory, trouble, and alarm conditions for each component of the system
- i. Battery standby calculations showing total standby power and length of service required to meet the specified system requirements. These calculations shall provide a minimum of a 20% safety factor
- j. A description of the sequence of operation of the system. This shall include sufficient information so that the exact function is known for each installed device.
- k. A description of the product warranty and the system guarantee.

K. The Contractor shall not order any equipment nor perform any installations prior to completion of review of the post-award submittals and any necessary resubmittals by the Owner and the Engineer and receipt of written authority to proceed to the next milestone from the Owner.

L. Project Completion Submittal - As a minimum the contractor shall submit six (6) copies of the following prior to performing final acceptance testing:

- 1. As-Built Drawings
- 2. Operating Instructions.

3. Testing Instructions
 4. Maintenance Instructions
 5. Final Acceptance Test Plan
 6. Signed warranty statement.
- M. The Contractor shall not perform the final acceptance test prior to completion of review of the project completion submittals and any necessary re submittals by the Owner and the Engineer and receipt of written authority to proceed to the next milestone from the Owner.
- N. Review of the initial project completion submittal will be completed at no cost. The cost of reviewing re submittals, for reason of failure of the initial submittal to meet contract requirements, shall be the responsibility of the contractor. The Engineer will directly invoice the cost at published rates, to review additional submittals, to the contractor. Payment of the invoices will be required before written authority to proceed to the next milestone is issued.
- O. Correcting and resubmitting of a project completion submittal shall be performed as follows. A copy of the previously submitted transmittal including all reviewers' comments and written responses shall be included in the re submittal. If changes other than those noted by the Owner or the Engineer are performed, then direct specific attention in writing or on the resubmitted document shall be made to those revisions.

Part - Products

System Function

- A. General: The microprocessor-based fire alarm system shall be UL listed and FM approved for Fire, Audio, Evacuation, and Security applications. In the event of a loss or failure of the primary CPU located at the FACP, any remote panels shall continue to perform their respective detection, annunciation, signaling, and/or control functions on a stand-alone or sub-network basis. The system shall provide a means to: detect fire/smoke conditions throughout the facility complex; detect the flow of water due to the operation of a sprinkler; allow staff to report the discovery of a fire within the protected property; communicate the discovery of a fire to the occupants using a voice evacuation system, and to the Alarm Monitoring Station through the network connection; monitor each system component for conditions which would impair proper system operation, annunciate such abnormal conditions, and control related equipment.
- B. The system shall be designed to ensure that alarm signals override supervisory and trouble signals.
- C. Upon the activation of a smoke detector, heat detector, manual fire alarm box, or water flow indicator, the system shall transfer to the "Alarm" state and shall operate as outlined in Section 2.2 of this Specification.
- D. Upon the occurrence of an abnormal condition of a monitored component or point, the system shall transfer to the "Supervisory" state and shall operate as outlined in Section 2.3 of this Specification.
- E. Upon the occurrence of an abnormal condition on Initiating Device Circuits (IDC), Signaling Line Circuits (SLC), or Notification Appliance Circuits (NAC), the system shall transfer to the "Trouble" state and shall operate as outlined in Section 2.4 of this Specification.

Alarm Condition

- A. System operation shall ensure that the alarm operation of any alarm initiating device shall not prevent the subsequent alarm operation of any other alarm initiating device due to wiring or power limitations.
- B. The system alarm operation activation of any manual fire alarm box, automatic detection device, or sprinkler waterflow switch shall perform the functions contained in this section:
 - 1. Transmit a signal over the network, if present.
 - 2. Alarm Indication: The following shall be displayed or printed on the building's fire alarm control panel, and annunciator:
 - a. Alarm conditions shall be immediately displayed on all alarm indicators on an alphanumeric display indicating all

information associated with the fire alarm condition including type of device, its location, and the time and date of activation in plain English. Alarm LED's shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on indicating the alarm still exists. A subsequent alarm received from another zone after acknowledgment shall flash the alarm LED on the control panel and the panel display shall show the new alarm information.

- b. During an alarm condition, a pulsing alarm tone shall sound within the control panel until the alarm is acknowledged.
- c. If the audible alarm signals are silenced for any reason, they shall automatically resound if another alarm zone is tripped.
- d. The alarm sequence shall be logged into memory together with the time and date of all occurrences.
- 3. Activate Notification Appliances
 - a. Operate available notification devices on all floors in accordance with building code requirements.
 - b. Any subsequent alarm shall reactivate the audible and visual signals.
- 4. All System output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated System Outputs (Alarm Indicating Appliances and/or relays) shall be activated.
- 5. If more than one alarm signal is in the system, the operator shall be able to scroll the display to view new signals.

Supervisory Condition

- A. The control panel shall have a system supervisory LED and a supervisory signal acknowledge switch.
- B. The activation of any standpipe or sprinkler tamper switch shall activate the supervisory signal.
- C. When a supervisory condition is detected, the following functions shall immediately occur:
 - 1. The System Supervisory LED shall flash.
 - 2. A pulsing tone in the control panel shall sound.
 - 3. Notify the Alarm Monitoring Station.
 - 4. Transmit a signal over the Fire Alarm network, if present.

5. The display shall indicate all information associated with the supervisory condition, including: device, its location within the protected premises, and the time and date of that activation.
 6. All system output programs assigned via control-by-event equations to be activated by the particular point in supervisory condition shall be executed, and the associated System Outputs (Supervisory Indicating Appliances and/or relays) shall be activated.
- D. Unacknowledged Alarm messages shall have priority over Supervisory messages. When an Alarm occurs during a supervisory sequence, the Alarm condition shall have display priority.
 - E. Activating the Supervisory Acknowledge Switch shall silence the audible signal while maintaining a lighted LED indicating that the supervisory condition is still abnormal.
 - F. Restoring the valve or supervisory contact to the normal position shall cause the supervisory service audible signal to pulse, thus indicating restoration to normal position. Activating the Acknowledge Switch shall silence the audible signal and restore the system to normal.
 - G. If more than one supervisory signal is in the system, the operator shall be able to scroll the display to view new signals.

Trouble Conditions

- A. When a Trouble condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
 1. The System Trouble LED shall flash.
 2. A pulsing tone in the control panel shall sound.
 3. Notify the Alarm Monitoring Station.
 4. Transmit a signal over the network, if present.
 5. The display shall indicate all information associated with the trouble condition, including: type of trouble point, its location within the protected premises, and the time and date of that activation.
 6. All system output programs assigned via control-by-event equations to be activated by the particular point in trouble shall be executed, and the associated System Outputs (Trouble Indicating Appliances and/or relays) shall be activated.
- B. Unacknowledged Alarm messages shall have priority over Supervisory messages and Trouble messages. When an Alarm occurs during a Supervisory or Trouble sequence, the Alarm condition shall have display priority.

- C. Unacknowledged Supervisory messages have priority over Trouble messages. When a Supervisory message occurs during a trouble sequence, the Supervisory condition shall have display priority.
- D. Activating the trouble acknowledge switch shall silence the audible signal while maintaining a lighted LED indicating that the trouble condition is still abnormal.
- E. Correcting the trouble shall cause the trouble service audible signal to pulse, thus indicating restoration to normal. Activating the Acknowledge Switch shall silence the audible signal and restore the system to normal.
- G. If more than one trouble signal is in the system, the operator shall be able to scroll the display to view new signals.
- H. Any trouble condition shall illuminate a common trouble LED on each annunciator.

System Integrity Monitoring

- A. All wiring extending from the Fire Alarm System Control Panel enclosure to system components shall be monitored for opens, shorts, and grounds. Unmonitored wiring from the control panel to system components shall not be acceptable.
- B. Incoming 120 VAC line power shall be monitored so that any power failure is audibly and visually indicated at the control panel and transmitted to the monitoring location.
- C. Batteries shall be monitored so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel and transmitted to the monitoring location.

System Reset

- A. A "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. Printed messages shall provide operator assurance of the sequential steps, i.e., "IN PROGRESS," "RESET COMPLETED," as they occur, should all alarm conditions be cleared.
- B. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The panel Alarm LED shall remain on. These points shall not require acknowledgment, if they were previously acknowledged.

Minimum Components

- A. The automatic fire detection and alarm system shall consist of, but not be limited to:
 - 1. Addressable Fire Alarm Control Unit, containing a power supply, Central Processing Unit (CPU), LED indicators, control switches, tone generator, and relays

2. Remote Control Transponders
3. Automatic Telephone Dialer
4. Master Fire Alarm Box
5. Remote Graphic Annunciator
6. Addressable manual fire alarm boxes
7. Addressable photoelectric open-area smoke detectors
8. Addressable photoelectric duct type smoke detectors
9. Addressable heat detectors
10. Addressable input devices (monitor modules) which interface with contact devices, including waterflow switches and valve tamper switches
11. Addressable Relay Output Modules which interface with magnetic door holders
12. Addressable Relay Output Modules (Control Modules) which interface with magnetic door holders, elevator controls, and ventilation controls
13. Audible and visual notification appliances
14. Audible and visual notification appliance synchronization modules
15. Site control connection
16. Battery back-up operation
17. Remote alarm indicating devices
18. Isolator modules
19. Automatic Door Releases
20. Alarm Monitoring Station alarm monitoring connection
21. Microphone
22. Network card to communicate over the network
23. Printer

Fire Alarm Control Unit

- A. The fire alarm control unit shall provide power, English display status,

monitoring, control, and programming capability for the fire detection and alarm system. The panel shall be UL listed for releasing service.

1. Acceptable Manufacturers of the Fire Alarm Control Panel shall be Notifier, Gamewell/FCI, EST.
- B. The control unit shall be contained in a single, NEMA-1 cabinet with a red door, per the requirements of the local code.
 - C. The control unit shall store a record of alarm, supervisory, and trouble events in a nonvolatile history file. This file shall contain at least the most recent 500 events, with time and date of each event. It shall be possible to select the number of events to be viewed in the history file, so that the entire file does not have to be downloaded. The history file shall remain intact in the event of a loss of AC and battery power.
 - D. The control unit shall be modular in construction and receive monitored plug-in component boards to provide system functions as hereinafter specified and/or to accommodate future system expansions.
 - E. The control unit shall be capable of being expanded and field reprogrammed at any time up to the predetermined maximum capacity of the system, without the requirement to return the operating system to the factory for program changes. All field programming shall be done by an authorized manufacturer's representative.
 - F. Initiating Device Circuits (IDC), Signaling Line Circuits (SLC), and Notification Appliance Circuits (NAC) shall not be loaded above 2/3 of maximum capacity to allow for future expansion.
 - G. The control unit shall support a minimum number of Signaling Line Circuits. Each Signaling Line Circuit shall support a minimum of 127 addressable detectors, addressable input modules, or addressable output modules.
 - H. The control unit shall accommodate all addressable input devices in alarm simultaneously and shall be capable of operating all addressable output relays while all addressable inputs are in alarm.
 - I. The control unit shall supply power and communication protocol signals to the addressable input devices over a single pair of wires per signaling line circuit from the control unit.
 - J. The control unit shall provide the operating power for both the visual and audible notification appliances. The audible notification shall be voice alarm, and shall have the capability of recorded and live voice transmissions.
 - K. Annunciation
 1. Annunciation shall be an integral part of the control system and shall indicate alarm, supervisory and trouble conditions, as well as the identity of the device initiating the signal.

L. In addition, the control unit shall contain the following:

1. Display: A minimum forty- (40) character, highly readable, display. Upon input activation, the display shall provide the following indications:
 - a. A device address display indicating the device number.
 - b. An English description of the type of device activated, such as smoke detector, manual fire alarm box, sprinkler waterflow, etc.
 - c. A field programmed English message indicating the location of the device.
 - d. The status of the input: alarm, supervisory, or trouble.
 - e. Multiple alarm conditions shall be sequentially displayed automatically at not more than a five- (5) second interval until manually acknowledged.
 - f. Once acknowledged, individual alarms shall be viewed by operating a "next-alarm" switch.
 - g. Microphone for live voice announcements.
 - h. Fiberoptic network card and all required associated equipment.
 - i. Communication Ports. Two supervised RS232C communication ports shall be provided to support a printer or MODEM. Each RS232C port output shall be programmable for printer or display output and shall be programmable to provide access to the control unit's EEPROM operating system to perform the following functions:
 - 1). Local or remote system programming.
 - 2). Listing and indicating status of all field devices.
 - 3). Performing alarm tests on any or all addressable smoke detectors and contact input devices.
 - 4). Monitoring of the system from a remote location via printer, terminal, or computer.
 - 5). A Real Time Clock. A real time clock shall be provided to continually provide time of day, day of week, calendar, and holiday control of relay functions. During normal standby conditions, the control unit shall display time and date.
 - j. Function Switches and LED's. The control unit shall be

provided with the following function switches and LED's:

- 1) Power-On LED: Shall indicate AC power-on under normal, supervisory, and alarm conditions.
- 2) Alarm LED: Shall indicate the existence of an alarm condition. It shall be redundant to the display.
- 3) Alarm Acknowledge Switch: Shall allow acknowledgment of each alarm before the system is silenced and reset.
- 4) Alarm Silence Switch: Shall silence alarm outputs and illuminate an LED. Any subsequent alarms shall re-sound the signals. The switch shall not be operable unless the alarm has been acknowledged.
- 5) Next Alarm: Shall allow the Ascroll@ display of multiple alarm condition Switch messages.
- 6) Supervisory LED: Shall indicate when the system is off normal condition, indicating when a device or component is not ready to operate. It shall be redundant to the display.
- 7) Supervisory Acknowledge Switch: Shall acknowledge each supervisory condition before the system is silenced and reset.
- 8) Next Supervisory Switch: Shall allow the Ascroll™ display of multiple supervisory messages.
- 9) Trouble LED: Shall indicate when the system has been compromised by electrical opens, shorts, or ground faults in the wiring, but not in alarm or supervisory condition.
- 10) Trouble Acknowledge Switch: Shall silence the control unit trouble buzzer and illuminate an LED. Subsequent trouble conditions shall re-sound the buzzer.
- 11) Next Trouble Switch: Shall allow the "scroll" display of multiple trouble condition messages.
- 12) Lamp Test: Shall illuminate all control unit LEDs and all segments of the switch display.
- 13) System Reset: Shall restore the system to normal standby monitoring condition. The switch shall be inoperable if all alarms are not properly restored.
- 14) Ground Fault: Shall indicate low resistance between positive or indication negative and ground in field

wiring or devices. For ease of troubleshooting, separate indications shall be provided for grounds on positive and negative wiring.

15) Battery Failure: Shall indicate battery voltage decay or disconnected batteries.

16) Battery Test: Shall load test battery capacity with display of battery voltage switch and current.

17) Zone Alarm LED: Shall indicate any alarm which occurs during CPU failure.

k. Any operation of an alarm silence, supervisory silence, trouble silence, acknowledge, lamp test, or system reset switch shall cause a display indication of operation with time and date. These operations shall also be recorded in the system's history file.

M. The functional operation of the control unit shall be established by programmable software.

I. The operating program shall be contained in nonvolatile EEPROM memory and shall be configured in any of the following ways:

a. At the factory.

b. At the job site via modem, or

c. At the job site via standard terminal and standard laptop computer. Laptop computers shall utilize standard communications software, such as Procomm or Crosstalk. Systems which require the manufacturer's proprietary software for programming and communication are not acceptable.

II. Access and control of the operating program shall be restricted to proper personnel designated by the authority having jurisdiction.

a. The control unit shall have a minimum of three (3) security levels, and they shall be designated: OWNER, INSTALLER, and MAKER. Each level shall have individual passwords. Illegal access attempts shall be rejected by the system and shall be displayed and recorded in the history file with time and date.

b. The OWNER security level shall be the lowest security level and shall only allow access to the system status levels and lists and shall not impair system operation.

c. The MAKER and INSTALLER security levels shall allow access to the operating system.

- d. Accessing a programming function that disables normal system operation shall initiate a trouble sequence.
- e. Access and programming capability at each security level shall be:

OWNER

- i. Print and display a detector list. The list shall provide the following information for each detector:
 - Device No. Four- (4) digit address
 - Detector-type Smoke detector, heat detector, etc.
- ii. Display relay list: Addresses with armed/disarmed status.
- iii. List active alarms.
- iv. List field device supply voltages.
- v. List notification appliance and control functions to be activated upon activation of each initiating device.
- vi. List owner's location messages.
- vii. List installed special function modules and their locations within the control unit.
- viii. List signal circuit output code patterns.
- ix. List RS232C ports status and assignment.
- x. Designate display clock to indicate in 24-hour (military) or 12-hour mode.
- xi. Choose whether or not to display battery voltage and current.
- xii. Change OWNER password.

INSTALLER

- i. Set or change input device address. Unit address shall be placed into detector memory.
- ii. Set input device owner location message.
- iii. Set a signal circuit output code. Shall be capable of being programmed for:

- steady-on, 60 BPM, 120 BPM, or temporal pattern.
 - iv. Set and list notification appliance and control functions to be activated upon activation of each initiating device.
 - v. Set the Real Time Clock program.
 - vi. Set execute/not execute of RTC.
 - vii. Disconnect addressable devices.
 - viii. Disconnect output circuits.
 - ix. Change INSTALLER password.
 - x. Display active trouble list.
 - xi. Set time and date.
 - xii. List, locate, and register control unit plug-in modules.
 - xiii. Set RS232C port communication parameters for display or printer output and set Baud rates within the range of 300 to 19,200.
 - xiv. Alarm test field input devices. True alarm test shall be accomplished by voltage change in ionization chamber or optical block and shall simulate contact transfer in manual fire alarm boxes, thermals, waterflows, etc. The system commands shall allow testing by device or group of devices.
 - xv. Control all functions of the OWNER password level.
 - MAKER
 - i. Control all programming and monitoring of password functions.
 - ii. Control all functions of INSTALLER and OWNER password levels.

M. Failure of the CPU(s) in the control unit module or a channel shall light the CPU Error LED and sound the control unit trouble tone. Alarms received while the control unit is in this state shall bypass the software and sound the general alarm signals, light the zone alarm LED, and activate the city master box.

N. The channel modules shall be field programmable to report wire-to-wire short conditions as either an alarm or trouble condition.

- O. The control unit shall be capable of locating input circuit openings by the associated device address and initiate the proper display and trouble sequence.
- P. The system response to alarms shall be 2.5 seconds maximum for the first alarm.
- Q. The control unit shall contain an integral standby battery to provide continuous power in the event of AC power failure.
 - 1. The batteries shall be capable of providing 60 hours of backup power for the system.
 - 2. Transfer from AC to battery power shall be instantaneous when AC voltage drops below 85 percent input.
 - 3. Transfer to battery standby shall be indicated by display and recorded in the history file with time and date. The indication shall be "AC OFF."
 - 4. During battery operation, the control unit shall process all input. However, in order to conserve battery power, the display may change operating mode to one in which it provides five (5) seconds of indication for each new input condition and subsequently turns off, during the period that the system is on battery support.
 - 5. The control unit shall have a dual rate battery charger that shall maintain the batteries in a fully charged condition and shall provide recharge of batteries to full capacity in forty-eight (48) hours.
 - 6. Loss of building power for the system shall automatically and immediately cause transfer of the system to battery power and cause all audible trouble signals to sound. Upon return of building power, the system shall automatically retransfer thereto, and the system shall automatically recharge the batteries.
 - 7. The control unit shall provide one non-programmable SPST relay with contacts rated 1 AMP at 24 VDC for:
 - a. Common alarm
 - b. Common supervisory
 - c. Common trouble
- R. The control unit shall provide one non-programmable DPDT relay with contacts rated 1 AMP at 24 VDC for:
 - 1. Common alarm
 - 2. Common supervisory
 - 3. Common trouble

- S. Output Function Modules. The control unit shall utilize output function modules to control output functions. The modules shall plug into the control unit motherboard. The functions and presence of each module shall be supervised, and INSTALLER and OWNER password shall enable the user to request a list that locates the module by panel and slot within the system. All modules shall be individually programmable by circuit as specified hereinafter.
1. Signal Audible Module - shall have two (2) output circuits. Each circuit shall be polarity reversing 1 AMP at 24 VDC. The circuits shall discriminate between open and short fault conditions with display of proper fault indication. The circuits shall be programmable for Style Y or Z monitoring.
 2. Relay Module - shall have two (2) DPDT relays. The relay contacts shall be rated 5 AMP at 24 VDC or 120 VAC resistive. The relays shall be monitored for open coil conditions.
 - a. One relay shall be provided for door holder release.

Air Sampling Smoke Detection - IF REQUIRED

- A. The system shall be installed in accordance with NFPA 72 and the manufacturer's guidelines. Acceptable manufacturers of air sampling smoke detection system are: Xtralis, Norwell, MA; Air Sense, Portland, OR; and Fenwal, Ashland, MA.
1. A high performance aspirating smoke detection system shall be supplied, installed and commissioned. The system shall consist of highly sensitive detector head which evaluates air samples that are drawn from the protected space through a network of sampling pipes. The detector shall consist of a minimum of smoke detector head, aspirating fans, controllers, filters, and a sampling pipe network. The network of piping shall be designed using a flow calculation method developed by the detector manufacturer. The calculations shall demonstrate that the transport time complies with NFPA 72 and that the system is balanced.
 2. The system shall interface with the main building Fire Alarm system for remote monitoring of multiple alarm levels and faults.
 - i. Detector Assembly:
 1. The detector shall be of the light-scattering or particle counting type utilizing a laser light source. The detector shall have the capability of providing multiple obscuration levels. The contractor shall select the obscuration level for each detector based on the manufacturer's recommendation for the application. The highest level of alarm shall correspond with an obscuration sensitivity equal to a point type photoelectric smoke detector.

2. The detector shall also incorporate facilities to transmit detector fault and air flow fault conditions.
3. The controller shall provide a visual indication of the smoke concentration in the detector.
4. The detector controller visual shall be divided into 10 percent increments. The alarm activation relay connections shall be software programmable and shall interface with any point on the detection scale.
5. The detector shall monitor itself for fault conditions which could impair the systems functionality. The system shall also incorporate a flow sensor which will monitor the piping for both high and low flow fault conditions. All air sampling detector faults shall activate a unique supervisory signal on the building fire alarm system.
6. Air sampling smoke detectors shall provide a minimum of four (4) levels of alarm.

- a. Initial detection alarm settings: Initial settings for the alarm level shall be:

Alarm Level 1: 20 percent of visual reading
Alarm Level 2: 40 percent of visual reading
Alarm Level 3: 70 percent of visual reading
Alarm Level 4: Obscuration level of a standard spot type Photoelectric

Smoke Detector

The manufacturer shall be consulted and alarm settings modified based on the manufacturers recommendations for the actual fire hazard present.

- b. Initial alarm delay thresholds: Initial settings for the alarm delay thresholds shall be:

Alarm Level 1: 10 seconds
Alarm Level 2: 10 seconds
Alarm Level 3: 10 seconds
Alarm Level 4: 5 seconds

7. Equipment Supplier

- a. The equipment supplier shall be authorized and trained by the manufacturer to calculate/design, install, test and maintain the air sampling detection system.
8. The air sampling pipe material type shall be approved by the owner prior to installation and shall be run unexposed and hidden from view. Air samples shall be taken from the rooms by capillary tubes. The subfloor piping shall run exposed in the subfloor. The piping for the ceiling level shall be run above the suspended ceiling until the orifice is reached.

9. The air sampling detector shall reset automatically when the main control panel is reset. A separate action to reset the air sampling detector shall not be required.
10. The detector(s) shall provide self-contained battery back-up for 60 hours of standby service followed by 5 minutes of alarm as required by NFPA 72. The batteries shall be sized with an additional 20% capacity to compensate for battery derating over their service life.
11. The maximum area covered by a single sampling port shall not exceed 400 square feet. A minimum of two air sampling ports shall be provided in each space.
 - a. Piping shall be marked every five feet identifying it as part of the smoke detection system. All sampling port orifices shall be marked in the field.
12. Alarm Devices and Sequence of Operation
 - a. Data Center
13. Auxiliary Functions - Trouble and Supervisory alarm signals from the air sampling smoke detection equipment shall be sent to the building fire alarm system.

Bi-Directional Antenna System

- A. The system shall be installed to provide reception and transmission capabilities of portable radios used by the local Fire Department.
 1. The system shall meet requirements of the Authority Having Jurisdiction.
 2. The system shall provide service in all areas of the building.

System Field Devices

- A. General
 1. All smoke and heat detectors and manual pull stations shall be new and of the addressable type.
 2. All water flow switches and valve tamper switches shall be used. The fire alarm systems contractor shall provide the appropriate addressable interface devices for connection of these switches to the fire alarm system.
 3. All addressable input and output devices shall be capable of being intermixed on the same field wiring circuit.
 4. Addressable devices shall communicate with the building Fire Alarm Control Panel over the signaling line circuit, providing Class A (NFPA-72 Style 6) monitoring.
 5. Contractor shall connect initiating devices and notification

appliances to appropriate circuits from each area.

6. Addressable devices shall operate under the following ranges of environmental conditions:
 - a. Ambient temperature: 32-120 degrees Fahrenheit.
 - b. Relative humidity: 0-85 percent, non-condensing.
7. Each addressable device shall include a means to assign a unique address code to the device in the field. This address code shall serve as the means by which the system program recognizes the device. Each addressable device shall be labeled with the unique address.
8. Failure of any single device shall not hinder the operation of any other devices connected to the circuit.
9. All automatic and manual initiating devices and notification appliances shall be located in conformance with all Codes and Regulations and these Specifications.
10. Failure of the control unit to properly communicate with any addressable device shall initiate the proper trouble sequence. While in this trouble condition, the control unit shall cause actual alarm input from devices to be reported as a zone alarm.

B. Automatic Detectors - General

1. All automatic detectors shall be of the addressable type.
2. Smoke detectors shall be mounted interchangeably into a common twist-lock base.
3. The control unit shall recognize changes of detector type in each location and provide proper indication that reprogramming for the affected address is required.
4. All automatic detectors located in locked rooms (including but not limited to mechanical, electrical, telephone, and custodial rooms) shall be equipped with a remote indicating light, indicating the detector address, mounted in the closest open corridor.

C. Addressable Photoelectric Smoke Detectors

1. Photoelectric smoke detectors shall have a sensitivity setting of 2.5% -3.0 % per foot obscuration.
2. Photoelectric smoke detectors shall be addressable and shall connect to one of the Fire Alarm Control Panel Signaling Line Circuits as indicated on the riser diagram.
3. The detectors shall be ceiling-mount and shall include a twist-lock base.

4. The detectors shall provide an alarm and power LED. The LED shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. The LED shall be placed into steady illumination under an alarm condition. An output connection shall also be provided in the base to connect an external remote alarm LED.
5. Photoelectric smoke detectors shall be located in conformance with all Codes and Regulations and these Specifications.

D. Detector Bases

1. Automatic detectors shall utilize a common, plug-in, twist-lock, tamper-resistant type base which accommodates ionization, photoelectric and thermal detectors. Detectors shall be interchangeable to simplify field conversion.
2. Removal of the detector from the base shall cause a trouble indication at the fire alarm control panel. Removal of the detector shall not disrupt the alarm circuit wiring or prevent the receipt of alarms from other devices operating in the circuit.
3. Insertion of an incorrect detector type into the base shall cause a "Wrong Device" trouble condition at the fire alarm control panel until the proper type of detector is installed, or the system is re-programmed. The system program shall recognize the insertion of a wrong device and shall automatically default to the set-point values corresponding to the inserted device, and shall monitor alarm and trouble conditions according to the default parameters.
4. Provide bases constructed of white, high impact polycarbonate designed for mounting on a standard 3-1/2 inch or 4 inch octagonal or 4 inch square outlet box. Provide screw terminal connections for No. 14 AWG wire.

E. Addressable Thermal Detector

1. Thermal detectors shall operate on the combination ARate-of-Rise@ and AFixed Temperature@ principles with the fixed temperature operation at 140°F or 190°F as indicated on the plans. The sensor shall also contain state-of-the-art dual thermistor sensing circuitry for fast response.
2. The thermal detector shall be ceiling-mounted and shall include a twist lock base.
3. Two LED visual indicators providing local 360 degree visibility of operating status and alarm indication shall be provided on each sensor. The LEDs shall pulse periodically indicating that power and communication is being supplied to the sensor. This feature shall be field programmable. Upon alarm, these two LEDs shall light continuously. A visible alarm signal shall be

capable of being remotely annunciated.

4. Thermal detectors shall be located in conformance with all Codes and Regulations and these specifications.

F. Conventional Thermal Detector

1. The conventional thermal detector shall be a Arate compensating@ detector with a fixed temperature rating of 190°F.
2. The thermal detector shall be sidewall mounted in the horizontal vent duct at the interface with the elevator shaft. The location shall allow servicing and testing from the attic. The detector shall be removable from its housing from the attic.
3. The detector shall be connected to an addressable monitor module from the buildings addressable fire alarm signaling line circuit. The monitor module, with led, shall be mounted on the third floor in the vicinity of the elevator doors. The module shall be located in an easily viewable area.
4. The detector shall have a protective guard supplied by the factory.

G. Addressable Manual Fire Alarm Boxes

1. Addressable manual fire alarm boxes shall be provided as indicated on the plans and in conformance with all Codes and Regulations and these Specifications. Manual fire alarm boxes shall be of the non-coded, double action type, surface or semi-flush mounted with integral contact monitor module to provide addressable operation.
2. Faceplates shall be red with raised white identification lettering.
3. Boxes shall mechanically latch after operation, with a key operated reset feature.
4. Each manual fire alarm box shall have a nameplate installed permanently on its face indicating its associated address.

H. Stopper Covers

1. Provide Stopper Covers where indicated on the plans. The protective shield shall be a tamper proof, clear Lexan cover installed over the manual pull station. When the protective shield is lifted to gain access to the manual pull station, the device shall sound a local audible indication horn. The horn will be powered by an integrally stored battery. The integral horn shall be silenced by replacing the cover over the manual pull station.
2. Battery shall provide a minimum of 1 year of service in standby

mode.

3. Provide 1 spare battery for each stopper cover installed.

1. Addressable Monitor Modules

1. Provide addressable contact input monitor modules to monitor the status of non-addressable, normally open, contact shorting type devices, including all waterflow valve tamper switches, and existing duct smoke detectors.
2. Wiring to the device(s) being monitored shall be Class A supervised (NFPA-72 Style 6). Status (normal, alarm, supervisory, trouble) shall be transmitted to the fire alarm control panel.
3. Monitor modules shall include a mounting plate for installation in a junction box.
4. The Monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box or to a surface mounted back box.

5. The Monitor module shall provide address-setting means.
6. An LED shall be provided which shall flash under normal conditions, indicating that the Monitor module is operational and in regular communication with the control panel.

J. Addressable Relay Output Modules

1. Provide addressable control relay output modules to permit hard wired control capability.
2. Relay contacts shall be DPDT, rated 2 amperes at 24 VDC, 0.6 amperes at 120VAC.
3. Provide suppressors for inductive loads.
4. Relays shall be monitored for trouble conditions (open, short, device missing/failed) at the fire alarm control panel.
5. Each relay shall operate according to the control program resident in the fire alarm control panel.
6. Relay output modules shall include a mounting plate for installation in a junction box.
7. The Relay Output Module shall provide address-setting means and shall also store an internal identifying code which the Control Panel shall use to identify the type of device.
8. An LED shall be provided that shall flash under normal conditions, indicating that the Relay Output Module is operational and is in regular communication with the Control Panel.

K. Addressable Duct-Type Smoke Detector

1. Duct-type smoke detectors shall be photoelectric-type smoke detectors and shall have a sensitivity setting of 2.5%-3.0% per foot obscuration.
2. Duct-type smoke detectors shall be addressable and shall connect with four wires (Class B) to one of the Fire Alarm Control Panel Signaling Line Circuits.
3. The photoelectric detectors shall be plug-in type heads located inside the duct detector housing.
4. The detectors shall provide an alarm and power LED. The LED shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. The LED shall be placed into steady illumination under an alarm condition. The detector shall have the capability to perform remote functional testing without generating smoke.
5. Duct smoke detectors shall be located in conformance with all Codes and Regulations and these Specifications.

6. Duct smoke detectors shall not activate the building wide alarm. They shall de-energize the HVAC unit associated with it, initiate a supervisory signal, and annunciate which device activated.

K. Isolator Module

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on a signaling line circuit (SLC) loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop to one floor.
2. If a wire-to-wire short occurs, the Isolator Module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section of the SLC loop.
3. The Isolator Module shall not require any address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.
4. The Isolator Module shall mount in a standard 4-inch deep electrical box, in a surface-mounted back-box, or in the Fire Alarm Control Panel. It shall provide a single LED which shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

L. Audible and Visual Notification Appliances

1. Speaker/Strobe type devices shall be used as the audible and visual alarm devices. The sound level of these fire signaling devices shall be at least 15 dBA above the average ambient sound level or 5 dBA above the maximum sound level.
2. Speakers in Acoustically Distinguishable Spaces shall produce voice intelligibility per NFPA 72.
3. All visual and audible notification appliances shall be synchronized.
4. Visual notification appliances shall be connected to the Fire Alarm Control Panel by Class B (NFPA-72 Style Y) circuits. They shall consist of Visual (Strobe) units, located as indicated herein.
5. Audible notification appliances shall be connected to the Fire Alarm Control Panel by Class A (NFPA-72 Style Z) circuits. They shall consist of speaker units, located as indicated herein.
6. Notification appliances shall be red with white lettering and be installed with flush, semi-flush, or surface trim and back boxes for all wall, column or ceiling mount audible-visible unit locations as indicated herein.
7. It is imperative that Speakers be so located that they can be readily and intelligibly heard in all areas to the decibel level required by all

authorities having jurisdiction.

8. Notification appliances shall be provided as indicated herein and shall be in conformance with all Codes, Regulations, and these Specifications.

M. Automatic Door Releasing Devices

1. Automatic door releasing devices shall be powered directly from the fire alarm panel.
2. The housing and contact plates shall be brushed zinc finish. Units shall have a holding force of approximately 35 pounds.
3. Operating voltage shall be 12 VDC, 24 VAC/DC and 120/250 VAC.

N. Remote Annunciator

1. Remote Annunciators shall indicate alarm, supervisory, and trouble conditions. It shall also identify the device initiating the signal. These indications shall be equivalent to those integral to the system control panel.
2. Remote Annunciators shall have the capability to acknowledge, silence and reset any trouble, supervisory or alarm condition in the same manner as the main fire alarm control panel.
3. Remote Annunciators shall have a microphone to make announcements for voice evacuation in the same manner as the main fire alarm control panel.

Part - Execution

Scheduling

- A. The Contractor shall provide a schedule to the Owner indicating the installation sequence and time frame. The Contractor must schedule and perform the installation and commissioning of the system without interfering with the construction and operation of the Facility. The following shall be performed:
 - 1. Install and bring on line the new fire alarm system control unit.
 - 2. Install and connect initiating devices and notification appliances as and when access to that portion of the Facility is permitted by the Owner.

Delivery, Storage, and Handling

- A. The Contractor shall deliver and store all equipment in shipping containers, with labeling in place. Storage locations and quantities shall be approved by the owner.

Installation - General

- A. The Contractor shall provide and install all required equipment and accessories necessary for the proper operation of the system.
- B. All work shall be performed in accordance with the best and most modern practices of the trade. The final installation shall present a neat appearance.
- C. The entire system shall be installed in a workmanlike manner, in accordance with the standard instructions and recommendations of the manufacturer and in accordance with the approved manufacturer's wiring diagrams, unless otherwise specifically permitted by the Engineer.
- D. The system shall be installed under the supervision of a qualified, trained manufacturer's representative. The system shall be demonstrated to perform all of the functions as specified.
- E. The supervisory work of the qualified manufacturer's technical representative shall include, but not necessarily be limited to: checking all the system wiring connections; advising the Contractor regarding technical details of the installation; and the adjustment and testing of all components of the system in order to ensure a complete and satisfactorily operable system. The representative shall also be required to instruct designated building and management personnel in the general operation of the system and to give the designated personnel an overview of the system functions when the system is in supervisory, alarm, and trouble modes.
- F. The manufacturer's technical representative's name and qualifications shall be submitted to the Engineer in writing. Once approved, the representative shall not be changed without at least two weeks' notice.

to the Engineer. The new representative must then be approved by the Engineer.

Installation - Field Devices

A. Automatic Detectors

1. Every automatic detector location shall be readily visible from the floor. Detector bases shall have markers attached to them indicating the address of the detector.
2. In general, automatic detectors shall be mounted on the structural ceiling or finished ceiling and not on the bottom or side of any type of construction or structure which extends down from the ceiling.
3. Automatic detectors shall be located near points where air currents normally intersect. However, no detectors shall be located in the direct path of the draft from an HVAC air supply grille, a door, window, or hallway.
4. Automatic detectors shall be located out of the direct stream of air currents.
5. All automatic detectors shall be installed in conformance with all Codes and Regulations and these Specifications.
6. Duct Smoke Detectors Shall be mounted by the HVAC contractor. All detectors shall be supplied and wired by the fire alarm contractor.

B. Manual Fire Alarm Boxes

1. Each manual fire alarm box shall be mounted in a clearly visible and accessible location.
2. Manual fire alarm boxes shall be mounted at a maximum height of 48 inches above the finished floor and within 5 feet 0 inches of each exitway.

Wiring Scheme

- A. No circuit shall be loaded to more than 67 percent of its listed capacity.
- B. Each floor shall be served by at least one signaling line circuit.

Wiring

- A. All new wiring shall comply with this section.
- B. All wiring pathways shall be installed to survivability level 2 per NFPA
- C. The Contractor shall furnish all conduit, wiring, outlet boxes, junction

boxes, cabinets, and similar devices necessary for the complete installation. All wiring shall be of the type recommended by the manufacturer, approved by the local Fire Department, and shall be installed in approved raceway throughout.

- D. All fire alarm conductors shall be installed in EMT. Wire runs to single detectors or modules may be made by MC cable.
- E. All conduit shall be routed so that its maximum temperature under worst-case operating conditions does not exceed 120 F (50 C).
- F. All conduit shall be rigidly mounted and braced as protection against vibration per the National Electric Code.
- G. All conduit shall be a minimum of 3/4" diameter.
- H. Penetrations of floor slabs or fire rated walls shall be fire-stopped in accord with all local codes. Listed through penetration systems shall be used.
- I. All wiring connected to the fire detection and alarm system shall be in full accordance with Article 210, "Wiring," and Article 760 "Fire Protective Signaling Systems" of the NFPA 70, National Electrical Code as referenced by the Massachusetts State Electrical Code.
- J. All junction box covers and conduit couplings, elbows, and unions shall be painted red. Items to be painted red shall be painted prior to installation and shall be painted off-site. No painting shall be performed in the facility.
- K. All conduit shall be labeled as A FIRE ALARM@ at minimum intervals of 25 feet. The labels shall be self-adhesive vinyl markers with a red background and a minimum of 2-inch white characters.
- L. MC cable shall have a colored red stripe indicating it is fire alarm cable. The red stripe shall be factory applied.
- M. All wiring shall be installed to National Electrical Code standards and color-coded throughout. Each circuit shall have a different and unique color of insulation which shall be consistent from the first connection to the last. At a minimum they shall be:
 - 1. Detection Circuit - Red and Black
 - 2. Detection Power - Violet and Brown
 - 3. Alarm Chime - Blue (+) and White (-)
 - 4. Alarm Strobe - Orange and Yellow
 - 5. AC Supply - White and Black
- N. All wiring for the initiating devices and notification appliances shall be solid copper and shall comply with the appropriate sections of the National Electrical Code. All system wiring sizes shall be as determined suitable by the manufacturer and in compliance with the National Electrical Code; however, they shall not be any smaller than as specified herein.

- O. The following minimum sizes of conductors shall be used for all wiring:
1. Power Supply Conductors: No. 12 AWG
 2. Automatic Detector and Manual Pull Station Conductors: No. 18 AWG
 3. Remote Annunciators: No. 18 AWG
 4. Remote Pilot Lamp Units: No. 18 AWG
 5. Notification Appliance Units: No. 14 AWG
- P. Raceways containing conductors identified as "Fire Protective Alarm System" conductors shall not contain any other conductors, and no AC carrying conductors will be allowed in the same raceway with the DC fire alarm detection and signaling conductors.
- Q. No more than two conductors of any one signaling line or initiating device circuit shall be run in a length of conduit. This requirement may be suspended where site conditions warrant. The decision to suspend this requirement shall be made in consultation with the Engineer.
- R. Exposed raceways shall be run parallel and perpendicular to the walls and ceilings. Wherever practical, exposed raceways shall be run on the ceiling, as close as possible to a wall, or as high as possible on a wall. Where exposed raceways must cross under a structural beam or rib, they shall be run down on one side of the beam or rib, across its bottom, and up to the ceiling on the other side of the beam or rib. No spanning from beam to beam or rib to rib will be permitted. The use of a conduit body on one side of a beam or rib will be permitted provided it is readily accessible.
- S. The conductors for the notification appliance units shall not be installed in the same raceway as the conductors for the automatic detectors and the manual fire alarm boxes unless specifically permitted by the manufacturer and the Engineer.
- T. End-of-line resistors shall be furnished as required and shall be mounted as directed by the manufacturer.
- U. The field locations of all end-of-line resistors shall be labeled so that the devices can be easily located, and the locations shall be noted on the point-to-point drawings.
- V. The system control unit shall be arranged to receive power from a dedicated, two-wire, 30 amp, 120 VAC supply. All low voltage operations for all devices shall be provided from the control unit.
- W. The fire alarm control panel shall have a nameplate on the inside indicating the electric panel board and circuit breakers protecting the feeders to the control panel.
- X. All wiring within the control panel shall be neatly served in the panel gutters and secured by means of Thomas & Betts "Ty-Raps" or by other approved means.
- Y. All terminal cabinets shall be provided with terminal strips. Junction boxes with wire-nuts are not acceptable.

- Z. Vertical portions of supply and return conductors for all class AA@ circuits shall be separated from each other by a two hour fire rated assembly and be a minimum of 10 feet apart.

As-Built Drawings

- A. The contractor shall submit a complete set of as-built drawings to the Engineer. The Engineer will only review these drawings for the limited purpose of checking for general compliance with accepted drawing practices and conformance with the design concept and not to determine accuracy or completeness of the design. If for any reason at the discretion of the Engineer the drawings must be resubmitted, the Engineer will invoice the contractor at published rates for additional reviews. Retainage will not be released until these invoices are paid.
- B. Once the drawings are accepted, the Contractor shall deliver a complete set of reproducible as-built drawings, four (4) copies of the reproducible as-built drawings and a CAD disk containing the original as-built drawings to the owner upon completion of the system.
- C. A copy of the as-built drawings shall be submitted to the Fire Department prior to final acceptance.
- D. The as-built drawings shall show the following:
 - 1. The exact locations and installation details of the installed equipment and address of each device.
 - 2. The installed wiring and color coding and wire tag notations for the exact locations of all installed equipment.
 - 3. Specific point-to-point interconnections between all equipment and internal wiring of the equipment. Typical point-to-point wiring diagrams are not acceptable.
 - 4. Layout of the annunciator panel and designations of each indicator.
 - 5. All modifications to the facilities.
- E. A disk containing the alarm system program shall be delivered to the Owner.

Training Requirements

- A. Prior to final acceptance, the Contractor shall provide operation training to each shift of the Owner's personnel. Each training session shall be of a duration acceptable to the Owner and shall be conducted on shift or at a time acceptable to the Owner. Each session shall include an overview of the system and the devices connected to it, emergency procedures (including alarm, trouble, and supervisory condition procedures), control panel operation, and safety requirements. Each session shall include a complete demonstration of the system. Dates and times of each training period shall be

coordinated through the Owner, not less than two (2) weeks prior to the training session.

Operating Instructions

- A. The Contractor shall provide Operating and User Instruction Manuals prior to testing of the system. Six (6) complete sets of operating instruction manuals shall be delivered to the Owner upon completion, and one (1) shall be delivered to the Fire Department prior to final acceptance.
- B. User operating instructions shall be provided, prominently displayed on the cabinet front or on a separate sheet located next to the control unit in accordance with UL No. 864.

Testing Instructions

- A. Upon completion of the system, the Contractor shall deliver to the owner complete, simple, comprehensive, step-by-step testing instructions. These testing instructions shall give recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment and a complete troubleshooting manual explaining what might be wrong if a certain malfunction occurs and an explanation of how to test the primary internal parts of each piece of equipment. At a minimum, the instructions must include all functions required by NFPA 72.

Maintenance Instructions

- A. Prior to final acceptance, the Contractor shall provide six (6) complete sets of maintenance instruction manuals to the Owner.
- B. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:
 - 1. All aspects of the system operation and maintenance shall be detailed, including a written description of the specific system design (a typical description will not be accepted), system logic diagrams, electrical wiring diagrams of all circuits, drawings illustrating equipment locations, and technical data sheets describing each piece of equipment used in the system.
 - 2. Instructions for replacing any components of the system, including internal parts.
 - 3. Instructions for periodic cleaning and adjustment of equipment with a schedule of these functions.
 - 4. A complete list of all equipment and components with the addresses and phone numbers of both the manufacturer and local supplier of each item.

Final Acceptance Tests

- A. At the time "as-built" drawings and manuals are submitted, the Contractor

shall submit a "Test Plan" which shall describe how the system will be tested. This shall include a step-by-step description of all tests and shall indicate type and location of test apparatus to be employed. The tests shall demonstrate that the operating and installation requirements of this specification have been met. All tests shall be conducted in the presence of the Engineer and shall not be conducted until the "Test Plan" is approved.

- B. A pre-final test shall be conducted to verify proper system operation prior to final acceptance testing to be witnessed by the Fire Department. This pre-test shall include all of the same functions specified for the final acceptance test.
- C. If for any reason the system fails the pre-test witnessed by the Engineer, the Contractor shall be invoiced at published rates for all additional witnessed pre-tests necessary. Retainage will not be released until all invoices are paid. The fire department shall be notified that the system is not ready for final testing.
- D. At the final acceptance test, the manufacturer's technical representative shall deliver to the Engineer an Inspection and Test Report, which shall be completed in conjunction with the preliminary test and shall indicate the following:
 - 1. Building information, including name, address, and city.
 - 2. The Contractor's name, address, city, and telephone number.
 - 3. The control panel configuration, serial number, extent of battery backup.
 - 4. The quantity of alarm signal units, manual fire alarm boxes, and each type of detector. In addition, the connection position of each device shall be indicated, as well as the test result of each device and any subsequent action taken, record of the serial number of each device, and record of the sensitivity setting of each smoke detector.
 - 5. Pertinent comments regarding the installation, operation, testing, inspecting, or other aspects of the system.
 - 6. The manufacturer's technical representative shall print his/her name and affiliation and sign and date the document.
- E. The tests shall demonstrate that the entire control system functions as intended. All circuits shall be tested, including equipment shutdown and alarm signaling devices. In addition, supervision of each circuit shall be tested.
- F. Before the installation shall be considered complete and acceptable by the awarding authority, a final test on the system shall be performed. The test shall be performed by the Contractor's job foreman, in the presence of a representative of the manufacturer, the Engineer, and a representative of the Fire Department. In order to assure attendance of the Fire Department, prior to the final test, the Fire Department

must be provided reasonable notification of the test date (at least forty-eight (48) hours).

- G. The Contractor shall provide all the necessary personnel and equipment to conduct the tests.
- H. At a minimum, the Contractor shall perform the following:
 - 1. Operate every building fire alarm device to ensure proper operation, correct annunciation at the control panel. When the application of heat would destroy any detector, they may be manually operated.
 - 2. The initiating circuit and the signaling circuits shall be opened in at least two locations per zone to check for the presence of correct supervisory circuitry.
 - 3. One half of all tests shall be performed on battery standby power.
 - 4. Upon completion of the tests, the Contractor shall leave the fire alarm system in proper working order and without additional expense to the owner, shall replace any defective materials or equipment provided by him under this Contract within one year from the date of final acceptance by the owner.
- I. When the testing has been completed to the satisfaction of both the Contractor's job foreman and the representatives of the manufacturer, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the Engineer and the Fire Department.
- J. The contractor shall meter the batteries while the system is in standby mode and alarm mode to verify the battery calculations. The contractor shall provide a test report to the engineer and owner upon completion.
- K. The contractor shall provide the system completion certificate, required by NFPA 72, signed by the contractor and fire department to the owner and engineer upon completion of the test.

Accessories

- A. The Contractor shall furnish two (2) back up smoke detectors, (2) back up heat detectors for each temperature rating used on the project, and (2) back up bases of the make and model number used; one manual fire alarm box and back box; and one spare visual and audible alarm notification appliance unit and back box.
- B. All accessory parts shall be neatly and protectively packed into one or more cartons. The quantity, manufacturer, and model of each unit in the carton shall be identified on the outside of the carton. In addition, the name, address, and telephone number of the Contractor and of the manufacturer's local representative, plus the date of delivery shall be neatly identified on the cover of each carton.

Warranty

- A. The Contractor shall warrant all equipment and wiring free from defects in workmanship and inherent mechanical and electrical defects for a period of one year from date of the final acceptance.
- B. Manufacturer shall warrant all system equipment for a period of one (1) year from date of final acceptance of the system.
- C. Upon completion of the installation of fire alarm and protective systems equipment, the Contractor shall provide the Owner with a signed, written statement, substantially in form as follows:

"The undersigned, having engaged as the Contractor on the (Project) Fire Alarm System confirms that the fire alarm system equipment was installed in accordance with the wiring diagrams, instructions, and directions provided to us by the manufacturer and Engineer."

Part - MEASUREMENT AND PAYMENT

4.01 GENERAL

Separate measurement and payment will not be made for the work of this Section complete in place, but all costs therefore shall be included in the Contract Lump Sum Price for the work as indicated herein.

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
0XXX.000	Fire Alarm	LS

END OF SECTION